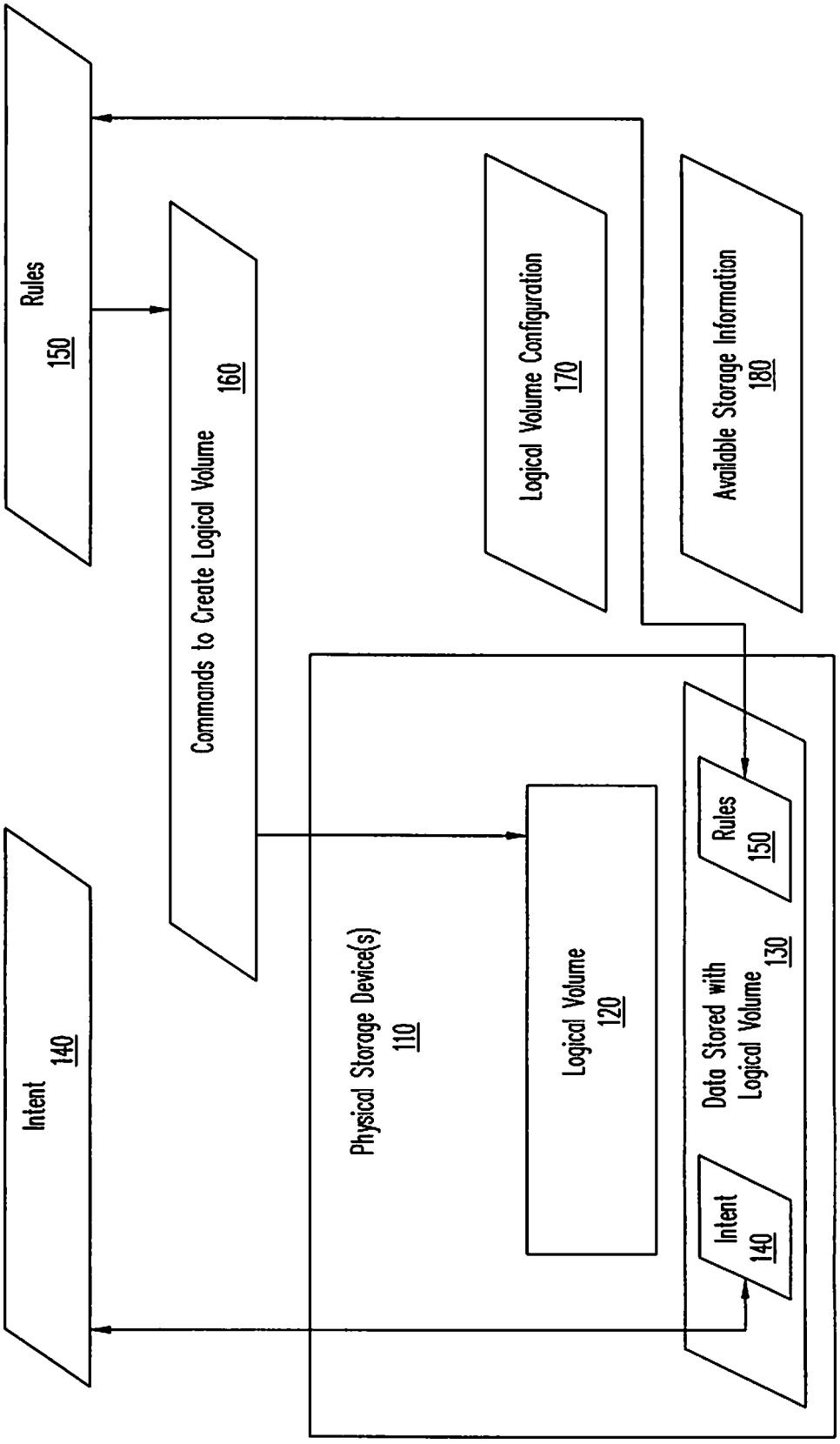

Rules
150
Commands to Create Logical Volume
160
Logical Volume Configuration
170
Available Storage Information
180
Intent
140
Physical Storage Device(s)
110
Logical Volume
120
Data Stored with Logical Volume
130
Rules
150
Intent
140

FIG. 1A

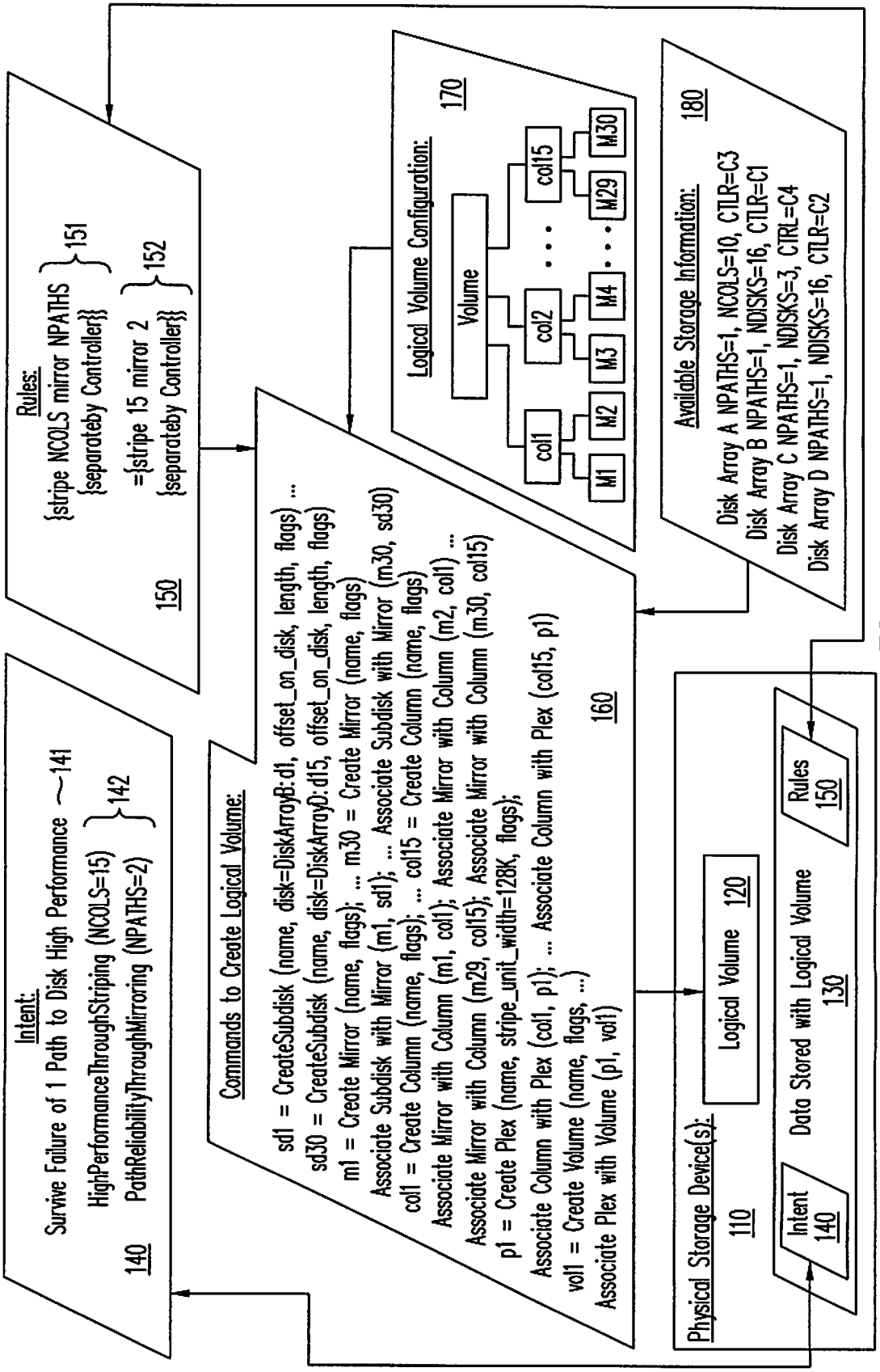
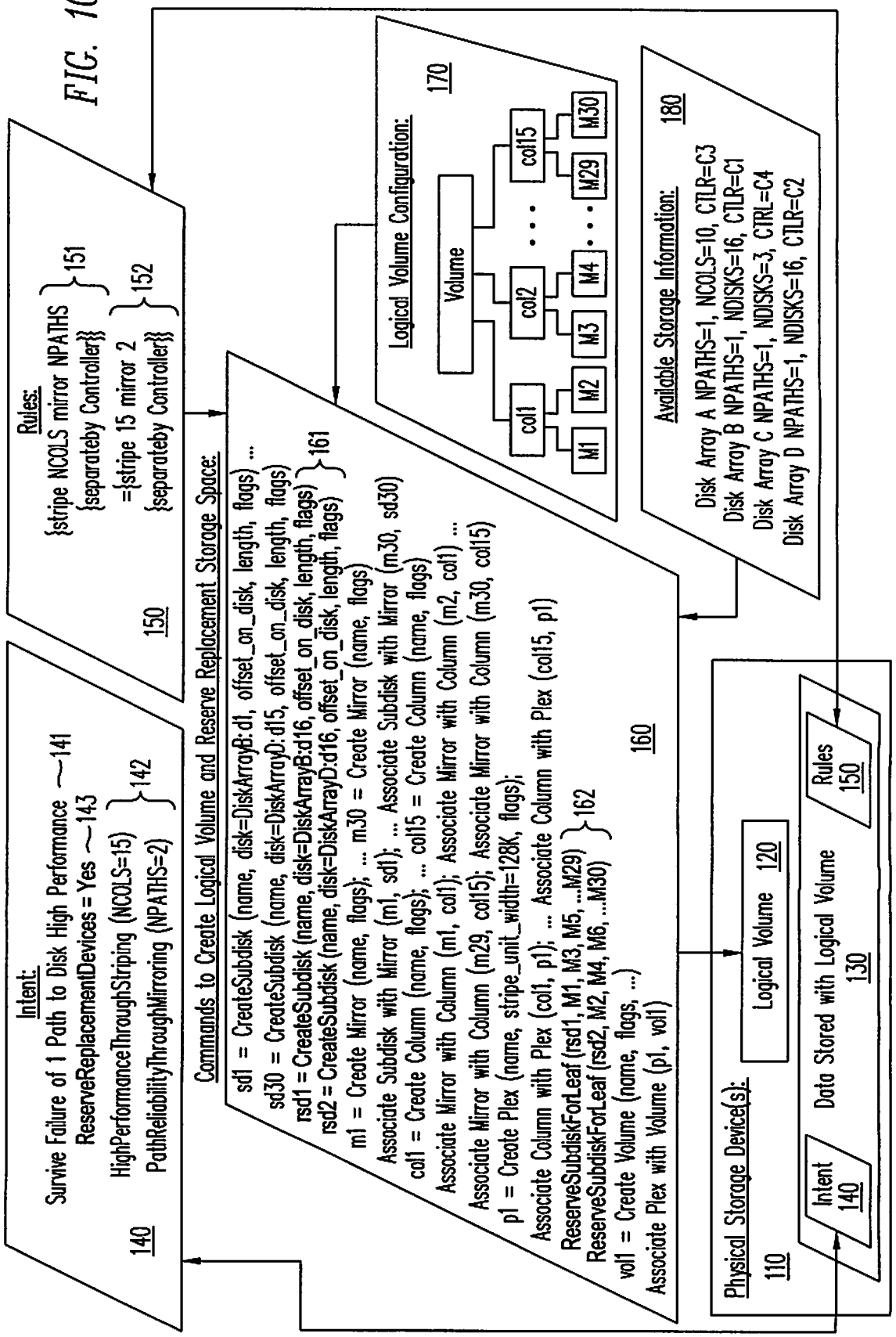

Intent:
Survive Failure of 1 Path to Disk High Performance
HighPerformanceThroughStriping (NCOLS=15)
PathReliabilityThroughMirroring (NPATHS=2)
140
141
142
Rules:
{stripe NCOLS mirror NPATHS
{separateby Controller}}
={stripe 15 mirror 2
{separateby Controller}}
150
151
152
Commands to Create Logical Volume:
sd1 = CreateSubdisk (name, disk=DiskArrayB:d1, offset_on_disk, length, flags) ...
sd30 = CreateSubdisk (name, disk=DiskArrayD:d15, offset_on_disk, length, flags)
m1 = Create Mirror (name, flags); ... m30 = Create Mirror (name, flags)
Associate Subdisk with Mirror (m1, sd1); ... Associate Subdisk with Mirror (m30, sd30)
col1 = Create Column (name, flags); ... col15 = Create Column (name, flags)
Associate Mirror with Column (m1, col1); Associate Mirror with Column (m2, col1) ...
Associate Mirror with Column (m29, col15); Associate Mirror with Column (m30, col15)
p1 = Create Plex (name, stripe_unit_width=128K, flags);
Associate Column with Plex (col1, p1); ... Associate Column with Plex (col15, p1)
vol1 = Create Volume (name, flags, ...)
Associate Plex with Volume (p1, vol1)
160
Logical Volume Configuration:
170
Volume
col1
col2
col15
M1
M2
M3
M4
M29
M30
Available Storage Information:
180
Disk Array A NPATHS=1, NCOLS=10, CTLR=C3
Disk Array B NPATHS=1, NDISKS=16, CTLR=C1
Disk Array C NPATHS=1, NDISKS=3, CTRL=C4
Disk Array D NPATHS=1, NDISKS=16, CTLR=C2
Physical Storage Device(s):
110
Logical Volume 120
Intent
140
Data Stored with Logical Volume
130
Rules
150

FIG. 1B

FIG. 1C


Intent:
Survive Failure of 1 Path to Disk High Performance
ReserveReplacementDevices = Yes
HighPerformanceThroughStriping (NCOLS=15)
PathReliabilityThroughMirroring (NPATHS=2)
140
141
143
142
Rules:
{stripe NCOLS mirror NPATHS {separateby Controller}}
={stripe 15 mirror 2 {separateby Controller}}
150
151
152
Logical Volume Configuration:
170
Volume
col1
col2
col15
M1
M2
M3
M4
M29
M30
Available Storage Information:
180
Disk Array A NPATHS=1, NCOLS=10, CTLR=C3
Disk Array B NPATHS=1, NDISKS=16, CTLR=C1
Disk Array C NPATHS=1, NDISKS=3, CTRL=C4
Disk Array D NPATHS=1, NDISKS=16, CTLR=C2
Commands to Create Logical Volume and Reserve Replacement Storage Space:
sd1 = CreateSubdisk (name, disk=DiskArrayB:d1, offset_on_disk, length, flags) ...
sd30 = CreateSubdisk (name, disk=DiskArrayD:d15, offset_on_disk, length, flags)
rsd1 = CreateSubdisk (name, disk=DiskArrayB:d16, offset_on_disk, length, flags)
rsd2 = CreateSubdisk (name, disk=DiskArrayD:d16, offset_on_disk, length, flags)
161
m1 = Create Mirror (name, flags); ... m30 = Create Mirror (name, flags)
Associate Subdisk with Mirror (m1, sd1); ... Associate Subdisk with Mirror (m30, sd30)
col1 = Create Column (name, flags); ... col15 = Create Column (name, flags)
Associate Mirror with Column (m1, col1); Associate Mirror with Column (m2, col1) ...
Associate Mirror with Column (m29, col15); Associate Mirror with Column (m30, col15)
p1 = Create Plex (name, stripe_unit_width=128K, flags);
Associate Column with Plex (col1, p1); ... Associate Column with Plex (col15, p1)
ReserveSubdiskForLeaf (rsd1, M1, M3, M5, ...M29)
ReserveSubdiskForLeaf (rsd2, M2, M4, M6, ...M30)
162
vol1 = Create Volume (name, flags, ...)
Associate Plex with Volume (p1, vol1)
160
Physical Storage Device(s):
110
Logical Volume 120
Intent 140
Data Stored with Logical Volume 130
Rules 150

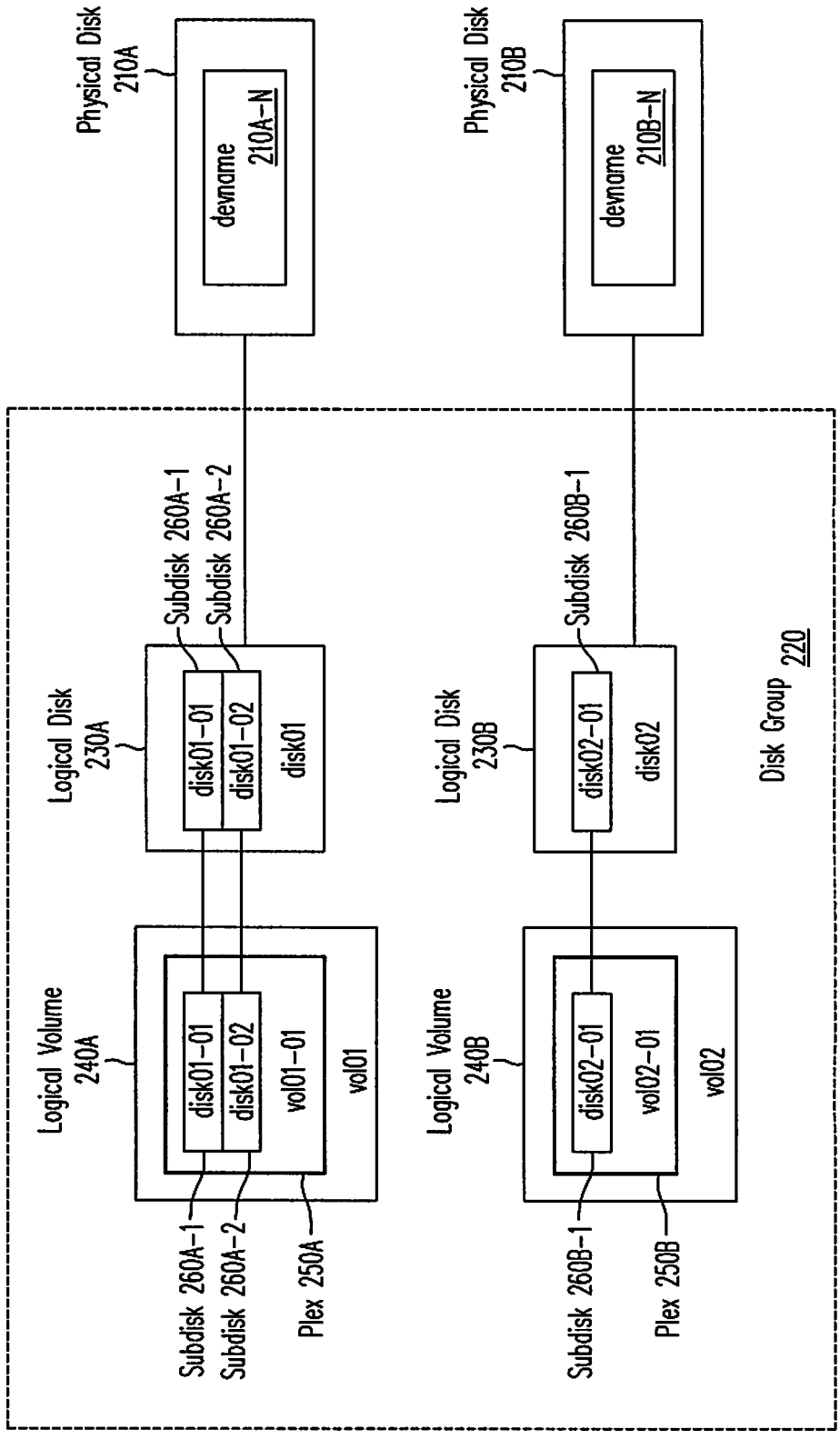
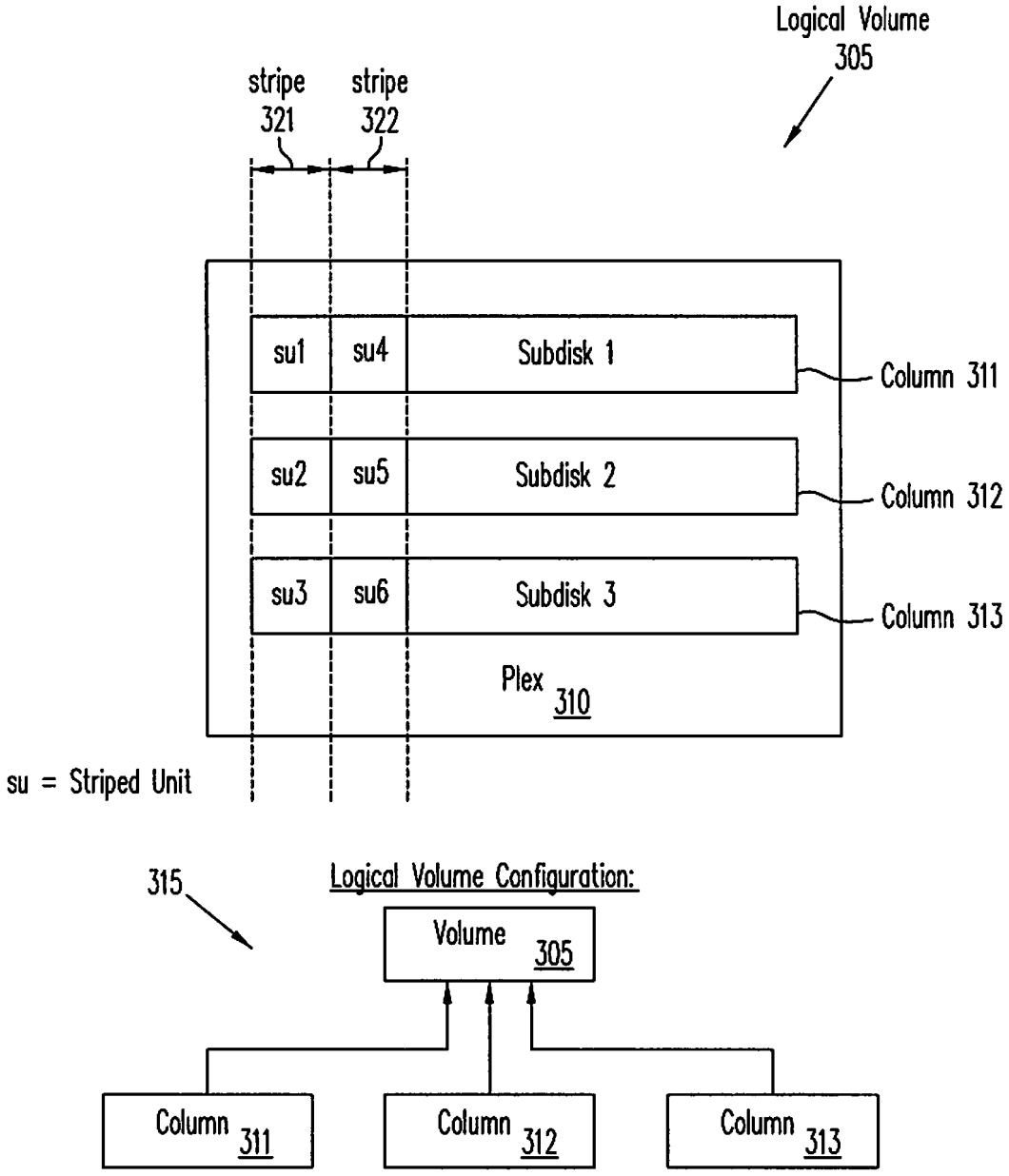
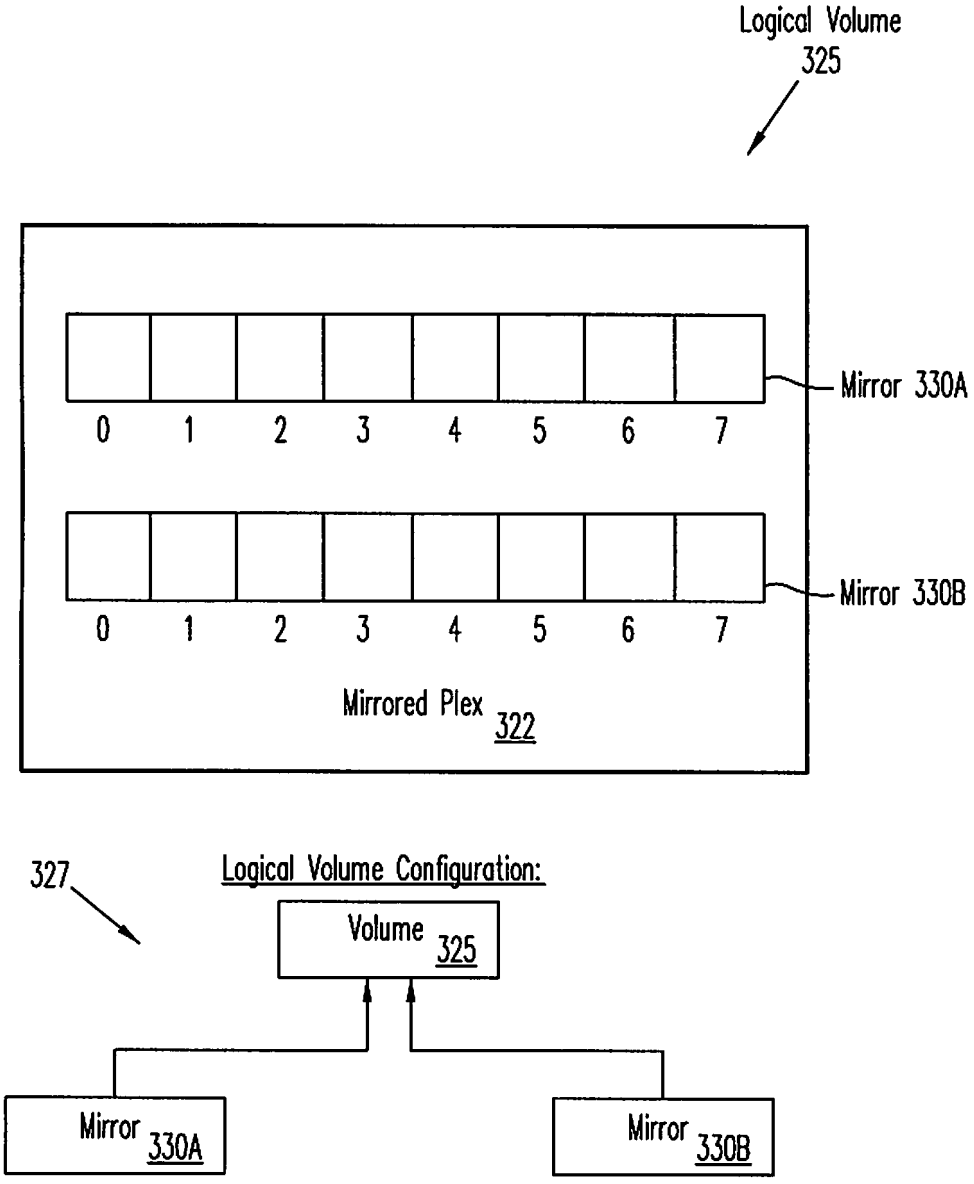

Physical Disk 210A
devname 210A-N
Physical Disk 210B
devname 210B-N
Subdisk 260A-1
Subdisk 260A-2
Subdisk 260B-1
Logical Disk 230A
disk01-01
disk01-02
disk01
Logical Disk 230B
disk02-01
disk02
Disk Group 220
Logical Volume 240A
disk01-01
disk01-02
vol01-01
vol01
Logical Volume 240B
disk02-01
vol02-01
vol02
Subdisk 260A-1
Subdisk 260A-2
Plex 250A
Subdisk 260B-1
Plex 250B

FIG. 2



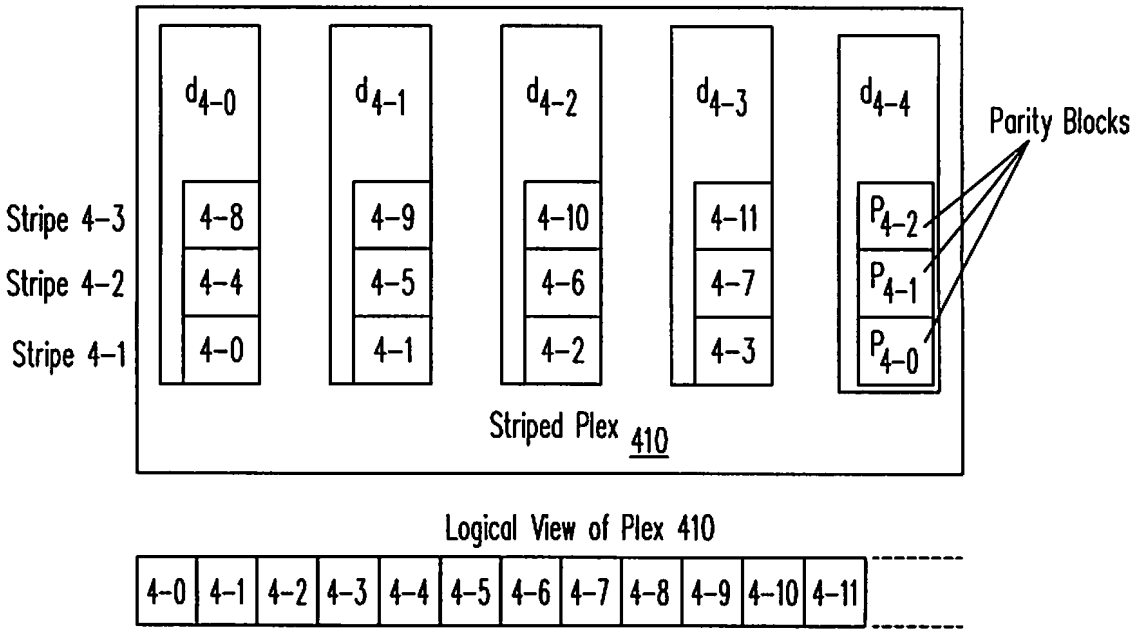
Striped Configuration (RAID-0)

FIG. 3A



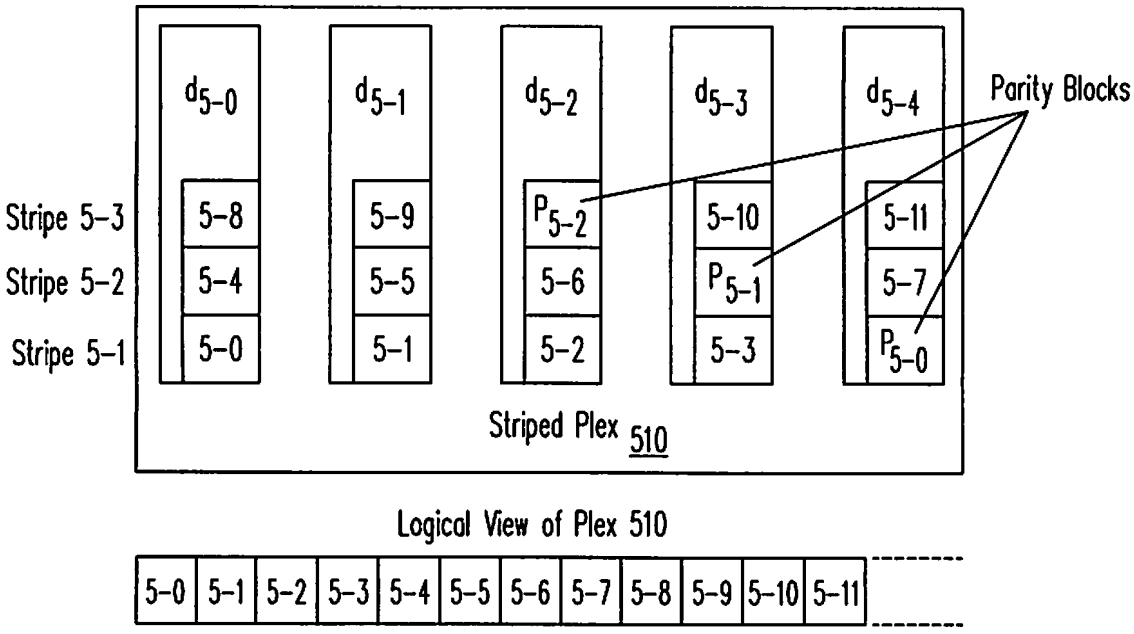
Mirrored Configuration (RAID-1)

FIG. 3B



RAID-3

FIG. 4



RAID-5

FIG. 5

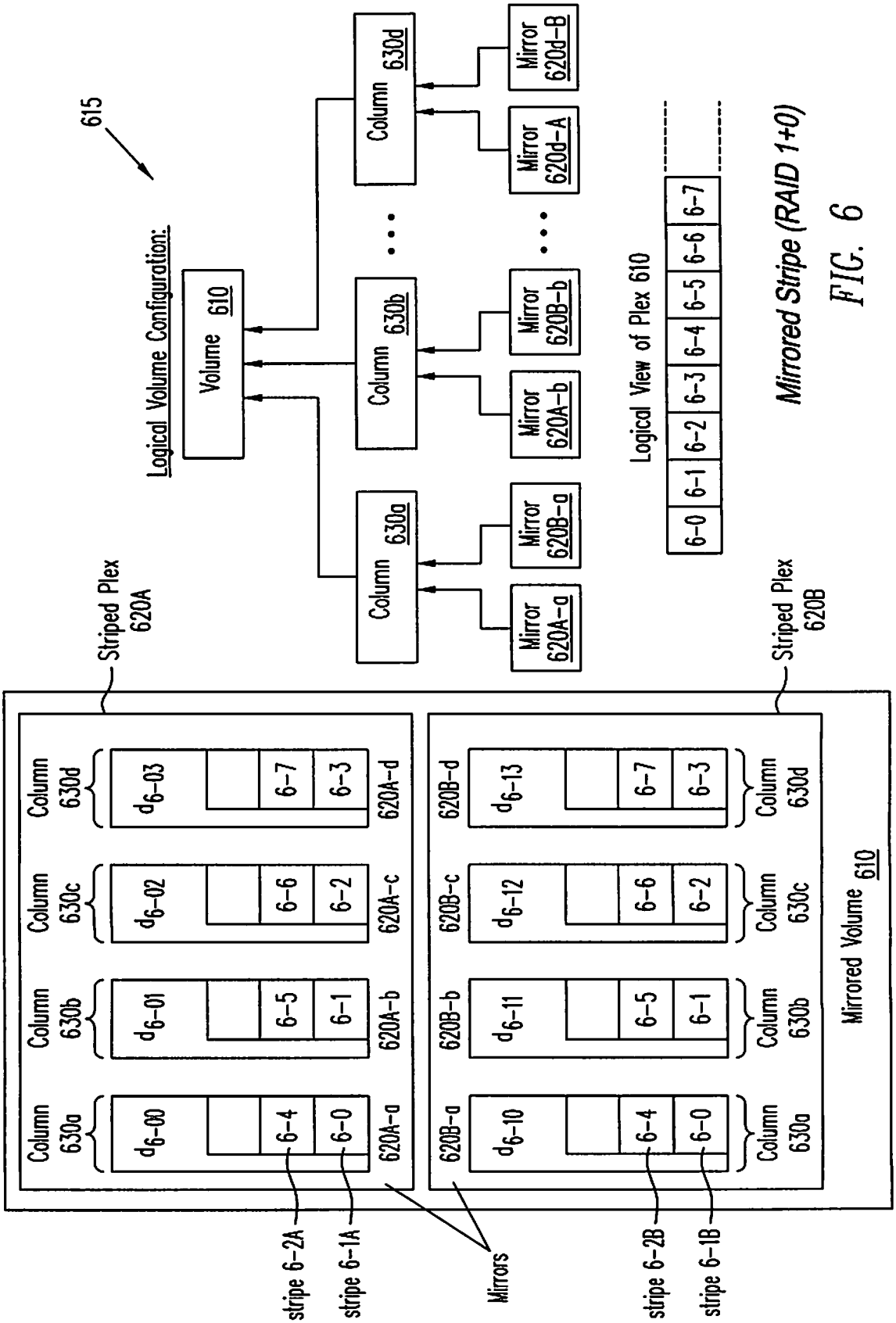

615
Logical Volume Configuration:
Volume 610
Column 630a
Column 630b
Column 630c
Column 630d
Mirror 620A-a
Mirror 620A-b
Mirror 620d-A
Mirror 620d-B
Mirror 620B-a
Mirror 620B-b
Striped Plex 620A
Striped Plex 620B
Logical View of Plex 610
6-0 6-1 6-2 6-3 6-4 6-5 6-6 6-7
Mirrored Stripe (RAID 1+0)
d_{6-00} d_{6-01} d_{6-02} d_{6-03}
d_{6-10} d_{6-11} d_{6-12} d_{6-13}
620A-a 620A-b 620A-c 620A-d
620B-a 620B-b 620B-c 620B-d
6-0 6-1 6-2 6-3 6-4 6-5 6-6 6-7
Mirrored Volume 610
stripe 6-2A
stripe 6-1A
Mirrors
stripe 6-2B
stripe 6-1B

FIG. 6

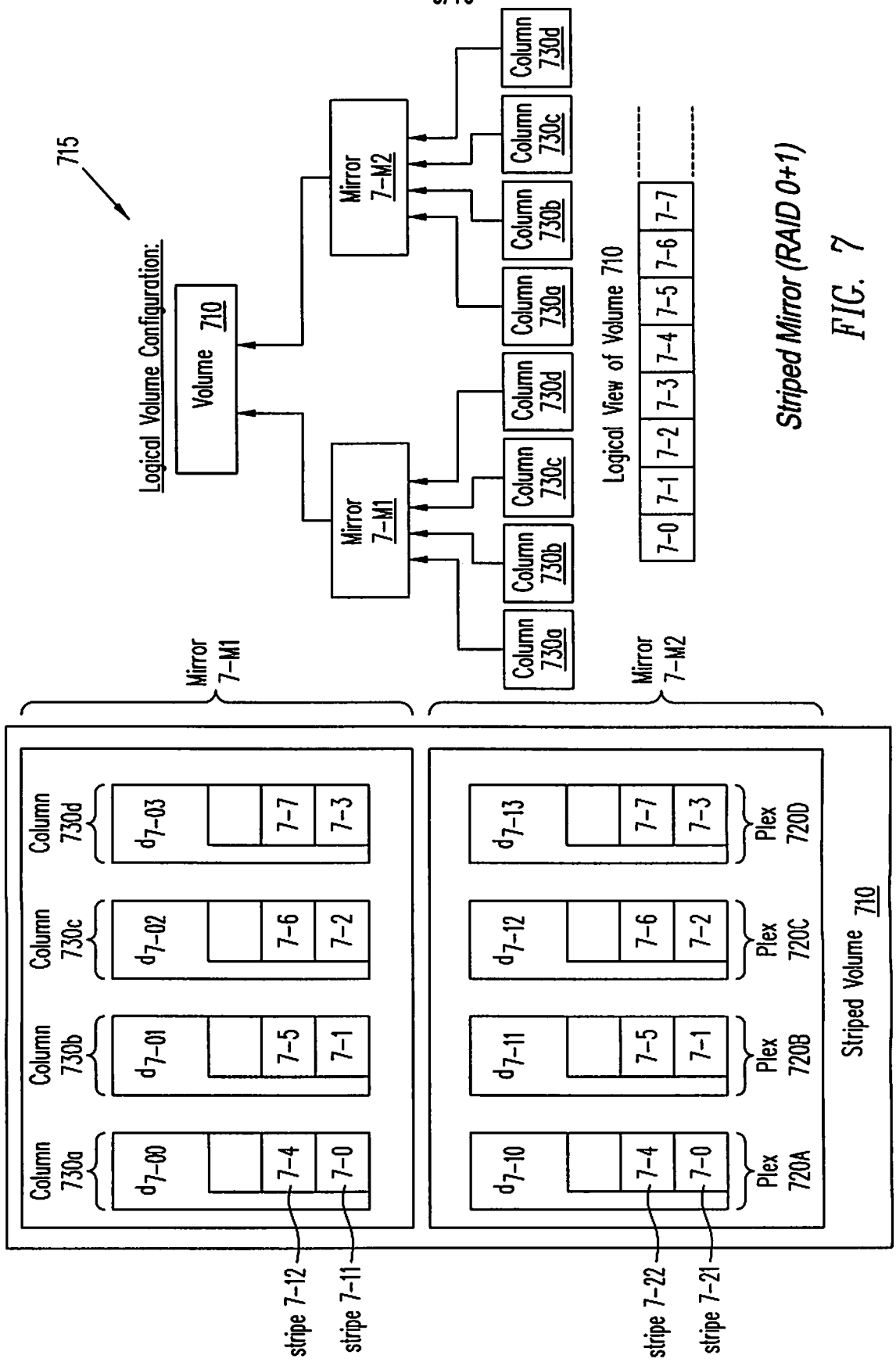
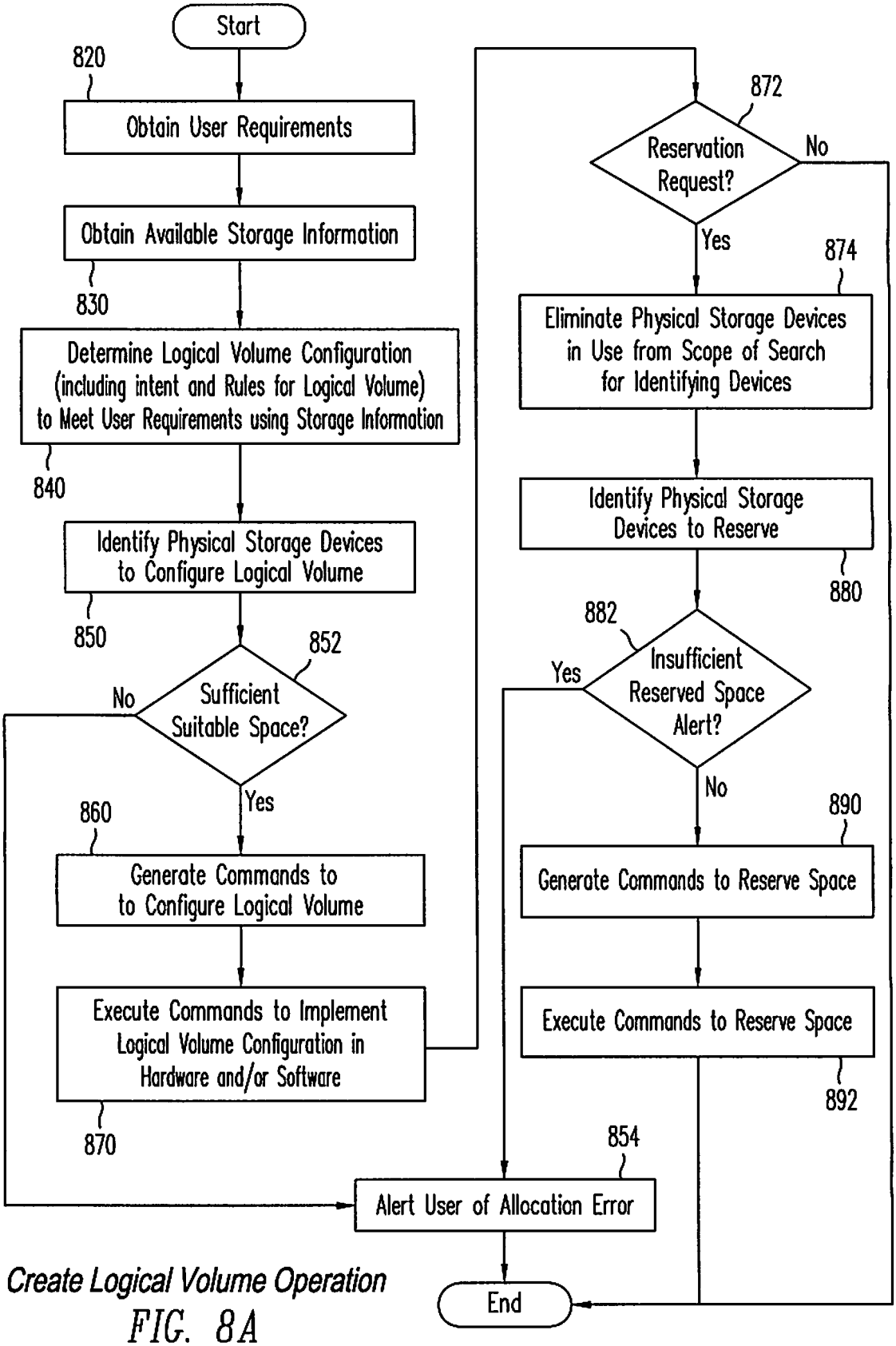
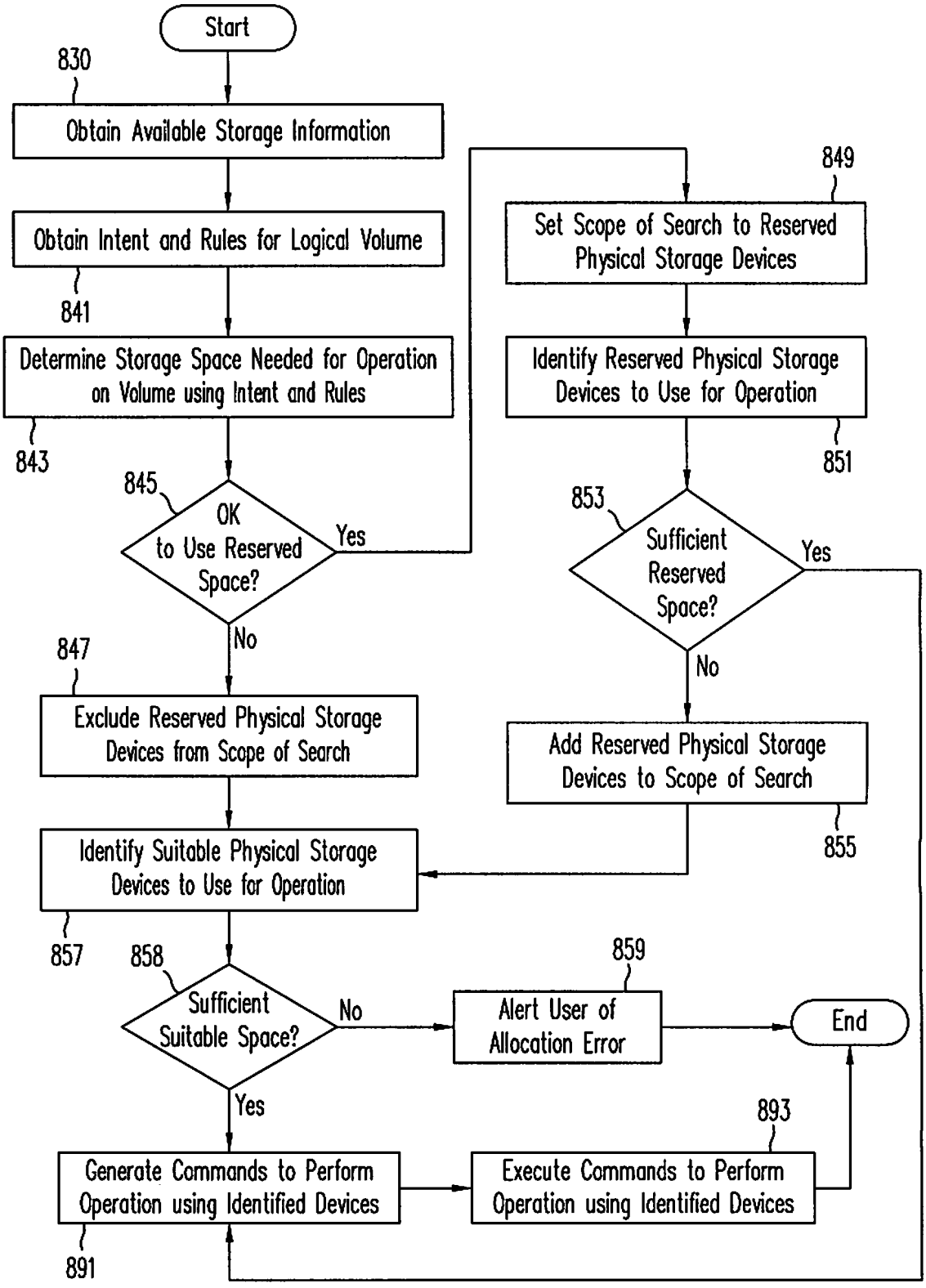

715
Logical Volume Configuration:
Volume 710
Mirror 7-M1
Mirror 7-M2
Column 730a
Column 730b
Column 730c
Column 730d
Logical View of Volume 710
7-0
7-1
7-2
7-3
7-4
7-5
7-6
7-7
Striped Mirror (RAID 0+1)
Striped Volume 710
Plex 720A
Plex 720B
Plex 720C
Plex 720D
d7-00
d7-01
d7-02
d7-03
d7-10
d7-11
d7-12
d7-13
stripe 7-12
stripe 7-11
stripe 7-22
stripe 7-21

FIG. 7



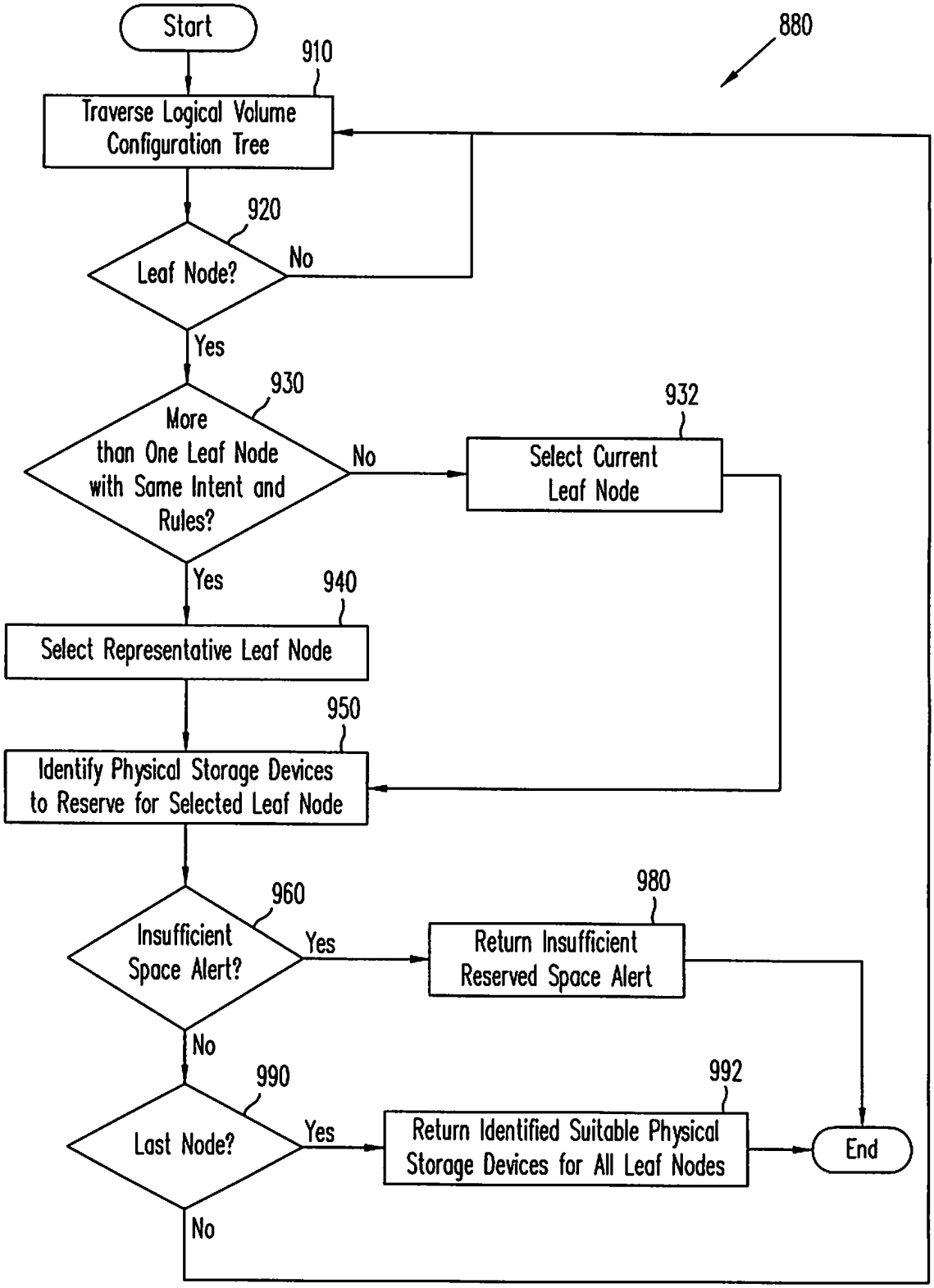
Create Logical Volume Operation

FIG. 8A



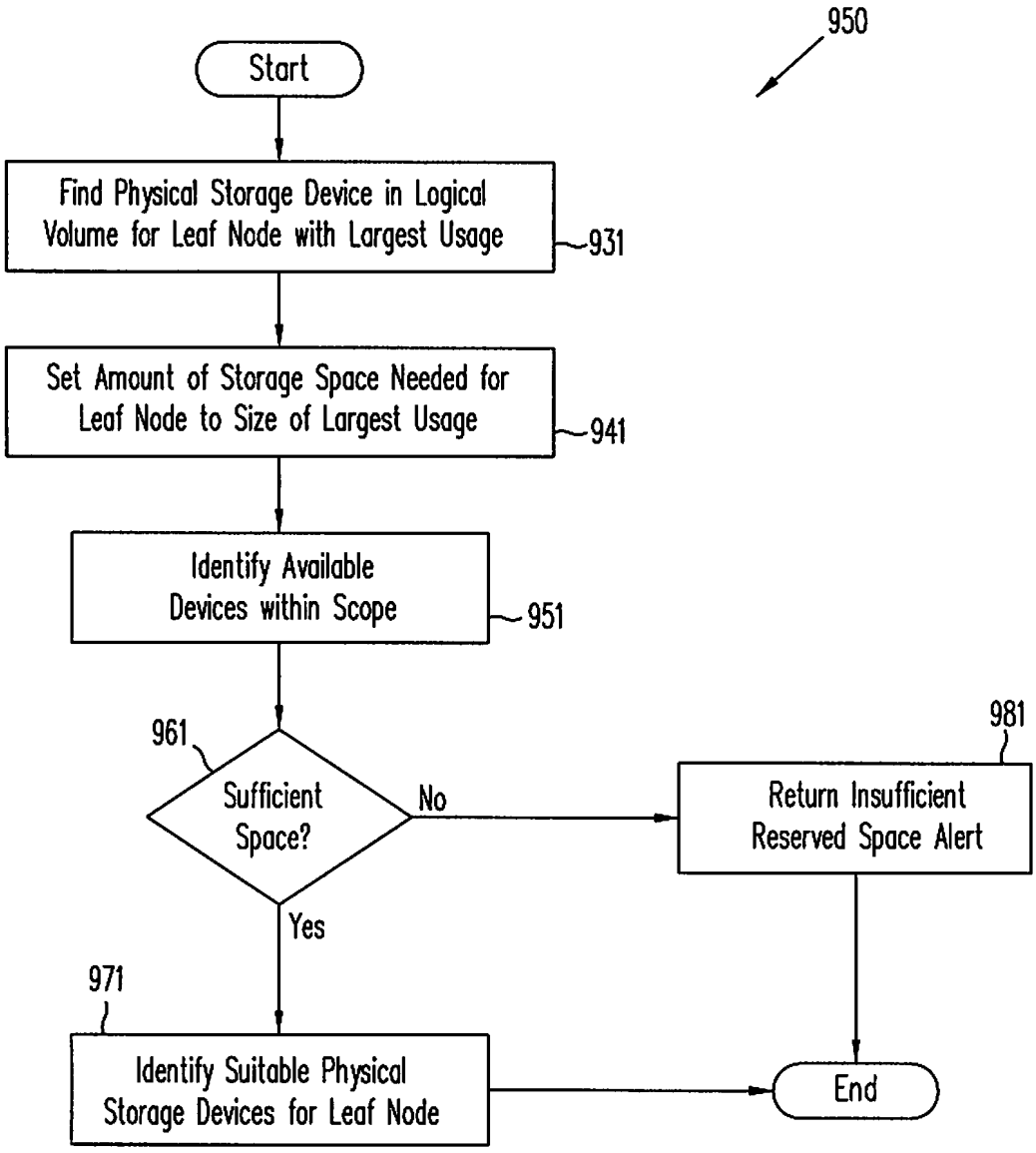
Other Operations on Logical Volumes

FIG. 8B



Reserve Space at Time of Volume Creation

FIG. 9A



Identify Physical Storage Devices for Leaf Node

FIG. 9B

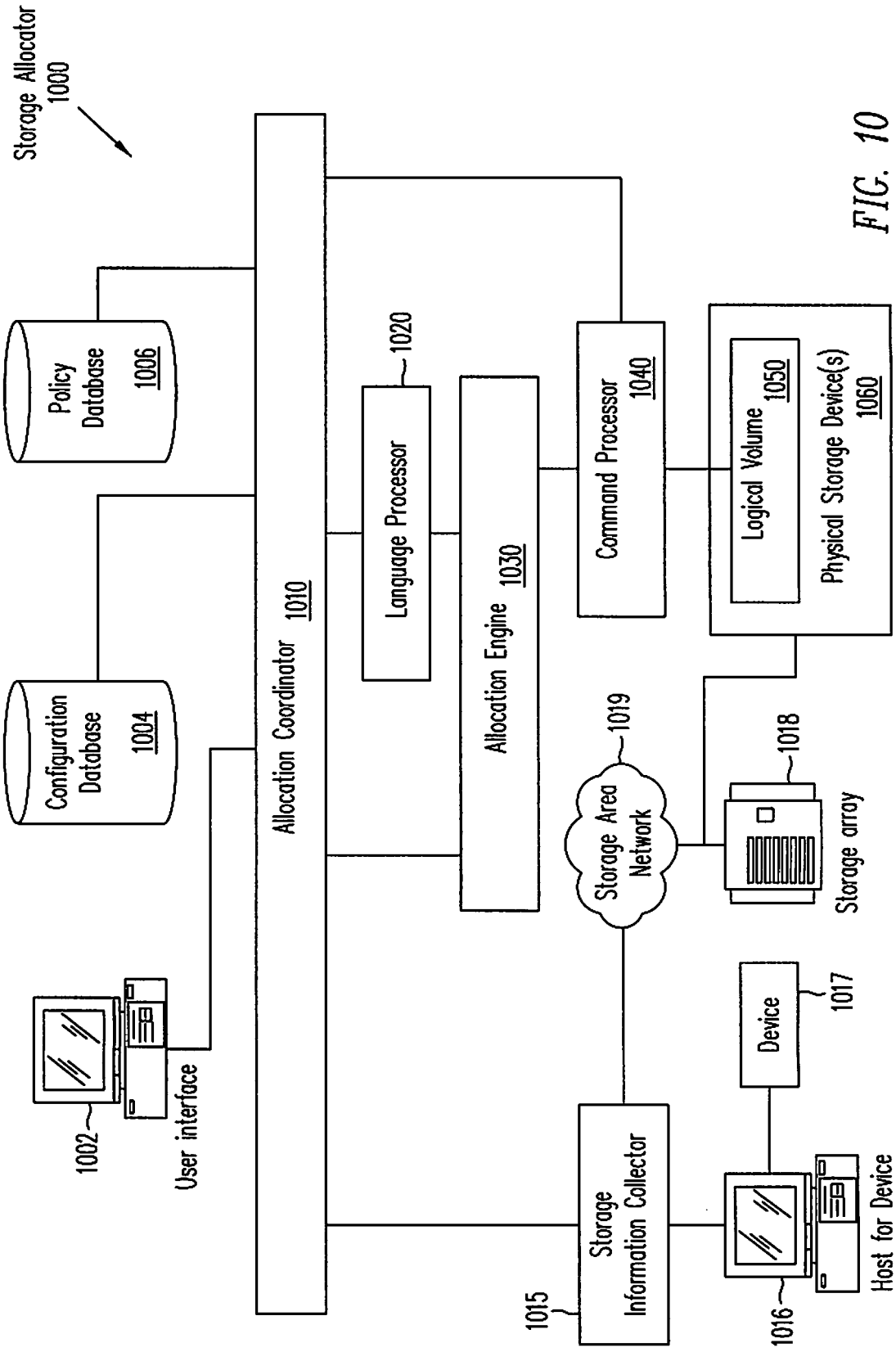

Storage Allocator
1000
Policy Database
1006
Configuration Database
1004
Allocation Coordinator
1010
Language Processor
1020
Allocation Engine
1030
Command Processor
1040
Logical Volume
1050
Physical Storage Device(s)
1060
Storage Area Network
1019
Storage array
1018
Device
1017
Storage Information Collector
1015
Host for Device
1016
User interface
1002

FIG. 10

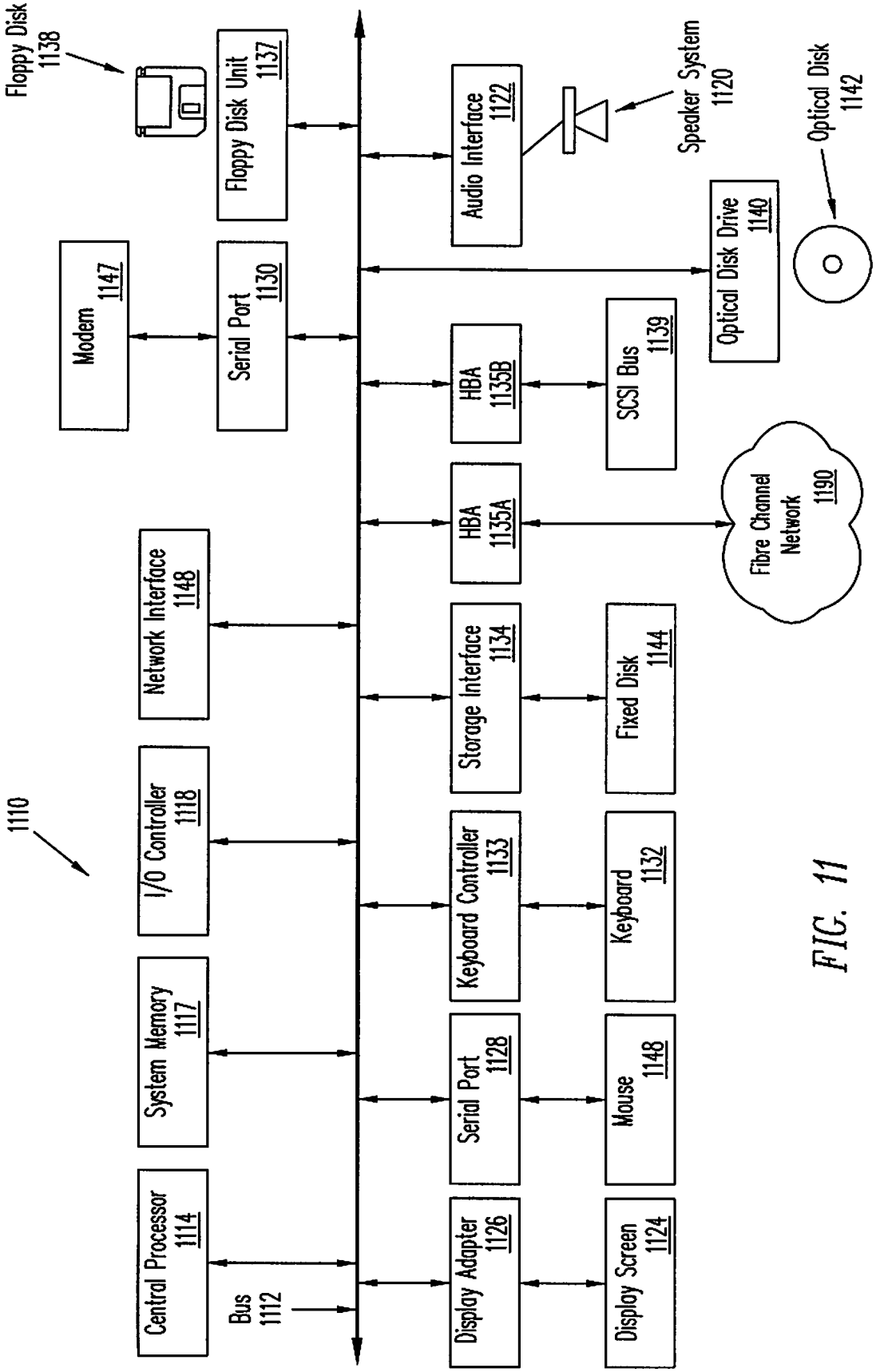

1110
Bus 1112
Central Processor 1114
System Memory 1117
I/O Controller 1118
Network Interface 1148
Display Adapter 1126
Display Screen 1124
Serial Port 1128
Mouse 1148
Keyboard Controller 1133
Keyboard 1132
Storage Interface 1134
Fixed Disk 1144
HBA 1135A
HBA 1135B
SCSI Bus 1139
Fibre Channel Network 1190
Optical Disk Drive 1140
Optical Disk 1142
Audio Interface 1122
Speaker System 1120
Floppy Disk Unit 1137
Floppy Disk 1138
Serial Port 1130
Modem 1147

FIG. 11

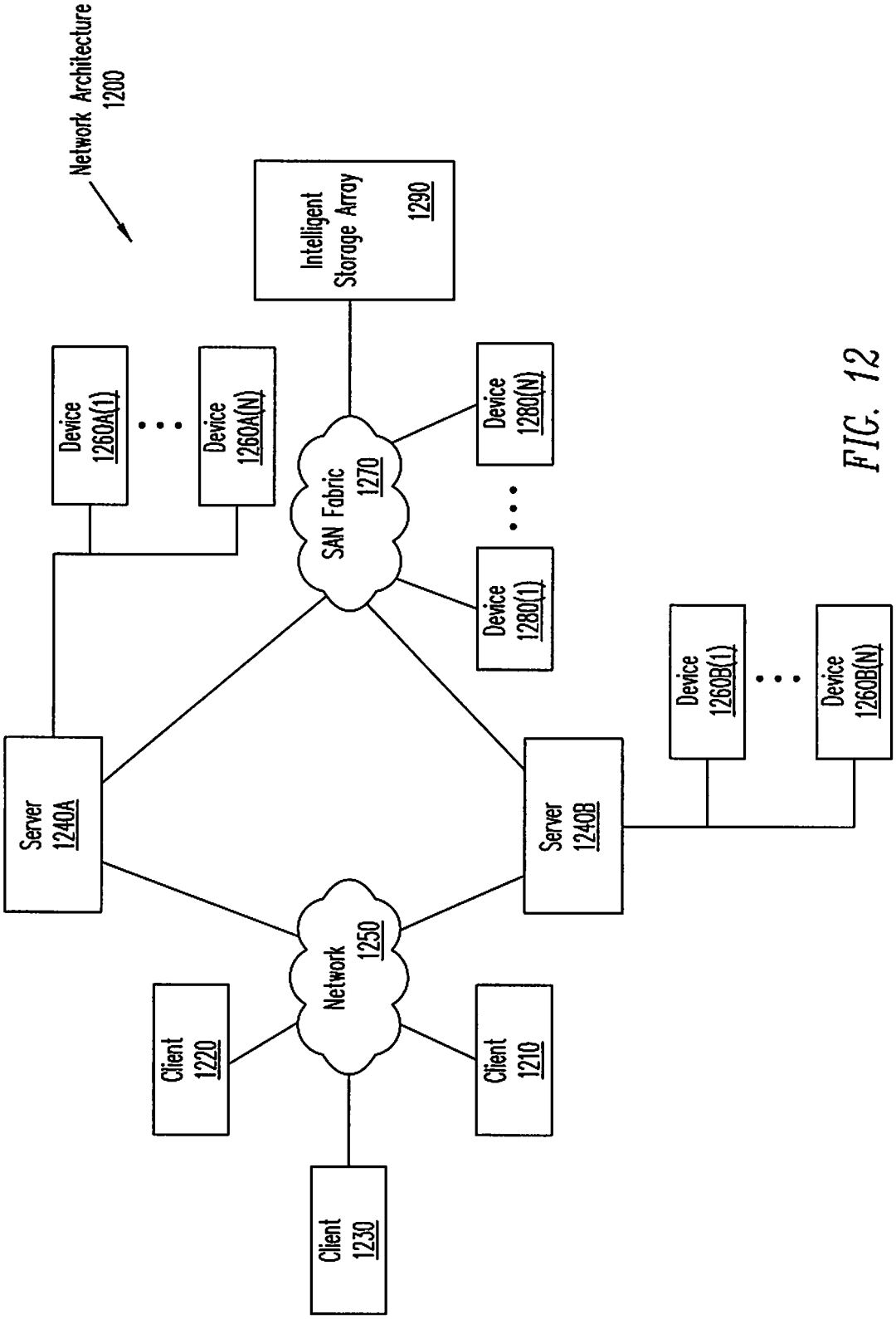

Network Architecture
1200
Intelligent Storage Array
1290
Device
1260A(1)
Device
1260A(N)
SAN Fabric
1270
Device
1280(N)
Device
1280(1)
Server
1240A
Server
1240B
Device
1260B(1)
Device
1260B(N)
Network
1250
Client
1220
Client
1210
Client
1230

FIG. 12